

ranging monitor as 125 percent of the maximum potential concentration and 125 percent of the maximum expected concentration if a second span is determined to be necessary under section 2.1.1.2 of this appendix. Determine concentrations of the calibration gases based upon the span value(s).

2.1.1.4 Adjustment of Span

Wherever the SO₂ concentration exceeds the maximum potential concentration but does not exceed the full-scale range during more than one clock-hour and the monitor can measure and record the SO₂ concentration accurately, it may be reported for use in the Acid Rain Program. If the concentration exceeds the monitor's ability to measure and record values accurately during a clock hour, and the full-scale exceedance is not during an out-of-control period, report the full-scale value as the SO₂ concentration for that clock hour. If full-scale exceedances occur during more than one clock hour since the last adjustment of the full-scale range setting, adjust the full-scale range setting to prevent future exceedances.

Whenever the fuel supply or emission controls change such that the maximum expected or potential concentration may change significantly, adjust the span and range setting to assure the continued proper operation of the monitoring system. Determine the adjusted span using the procedures in sections 2.1.1.1 or 2.1.1.2 of this appendix. Select the full scale range of the instrument to be greater than or equal to the new span value and to be consistent with the guidelines of section 2.1 of this appendix. Record and report the new full-scale range setting, calculations of the span, MPC, and MEC (if appropriate), and the adjusted span value, in an updated monitoring plan. In addition, record and report the adjusted span as part of the records for the daily calibration error test and linearity check specified by appendix B of this part. Whenever the span value is adjusted, use calibration gas concentrations based on the most recent adjusted span value. Perform a linearity check according to section 6.2 of this appendix whenever making a change to the monitor span or range. Recertification under §75.20(b) is required whenever a significant change in the monitor's range also requires an internal modification to the monitor (e.g., a change of measurement cell length).

2.1.2 NO_x Pollutant Concentration Monitors

Determine, as indicated below, the span value(s) for the NO_x pollutant concentration monitor so that all expected NO_x concentrations can be determined and recorded accurately including both the maximum expected and potential concentration.

2.1.2.1 Maximum Potential Concentration

The monitor must be capable of accurately measuring up to 125 percent of the maximum potential concentration (MPC) as determined below in this section. Use 800 ppm for coal-fired and 400 ppm for oil- or gas-fired units as the maximum potential concentration of NO_x, unless a more representative MPC is determined by one of the following methods (If an MPC of 1600 ppm for coal-fired units or 480 ppm for oil- or gas-fired units was previously selected under this part, that value may still be used.): (1) NO_x emission test results, (2) historical CEM data over the previous 30 unit operating days; or (3) specific values based on boiler-type and fuel combusted, listed in Table 2-1 or Table 2-2 if other data under (1) or (2) were not available. Multiply the MPC by 125 percent and round up to the nearest multiple of 100 ppm to determine the span value. The span value will be used to determine the concentrations of the calibration gases.

Report the full-scale range setting, and calculations of the MPC, maximum potential NO_x emission rate, and span in the monitoring plan for the unit. Select the full-scale range of the instrument to be consistent with section 2.1 of this appendix, and to be greater than or equal to the span value. This selected monitor range with a span rounded up from 125 percent of the maximum potential concentration will be the "high-scale" of the NO_x pollutant concentration monitor.

If NO_x emission testing is used to determine the maximum potential NO_x concentration, use the following guidelines: Use Method 7E from appendix A of part 60 of this chapter to measure total NO_x concentration. Operate the unit, or group of units sharing a common stack, at the minimum safe and stable load, the normal load, and the maximum load. If the normal load and maximum load are identical, an intermediate level need not be tested. Operate at the highest excess O₂ level expected under normal operating conditions. Make at least three runs with three traverse points of at least 20 minutes duration at each operating condition. Select the highest NO_x concentration from all measured values as the maximum potential concentration for NO_x. If historical CEM data are used to determine the MPC, the data must represent various operating conditions, including the minimum safe and stable load, normal load, and maximum load. Calculate the MPC and span using the highest hourly NO_x concentration in ppm. If no test data or historical CEM data are available, use Table 2-1 or Table 2-2 to estimate the maximum potential concentration based upon boiler type and fuel used.

TABLE 2–1.—MAXIMUM POTENTIAL CONCENTRATION FOR NO_x—Coal-Fired Units

Unit type	Maximum potential concentration for NO _x (ppm)
Tangentially-fired dry bottom and fluidized bed	460
Wall-fired dry bottom, turbo-fired dry bottom, stokers	675
Roof-fired (vertically-fired) dry bottom, cell burners, arch-fired	975
Cyclone, wall-fired wet bottom, wet bottom turbo-fired	1200
Others	As approved by the Administrator.

TABLE 2–2.—MAXIMUM POTENTIAL CONCENTRATION FOR NO_x—Gas- And Oil-Fired Units

Unit type	Maximum potential concentration for NO _x (ppm)
Tangentially-fired dry bottom	380
Wall-fired dry bottom	600
Roof-fired (vertically-fired) dry bottom, arch-fired	550
Existing combustion turbine or combined cycle turbine	200
New stationary gas turbine/combustion turbine	50
Others	As approved by the Administrator.

2.1.2.2 Maximum Expected Concentration

If the majority of NO_x concentrations are expected to be less than 25 percent of the full-scale range of the instrument selected under section 2.1.2.1 of this appendix (e.g., where a NO_x add-on emission control is used) use a “low-scale” measurement range. For units with add-on emission controls, determine the maximum expected concentration (MEC) of NO_x using Equation A-2, inserting the maximum potential concentration, as determined using the procedures in section 2.1.2.1 of this appendix. Where Equation A-2 is not appropriate, set the MEC, either (1) by measuring the NO_x concentration using the testing procedures in section 2.1.2.1 of this appendix, or (2) by using historical CEM data over the previous 30 unit operating days. Other methods for determining the MEC may be accepted if they are satisfactorily explained in the monitoring plan. If an existing State, local, or Federal requirement for span of an NO_x pollutant concentration monitor requires a span other than that required in this section, but less than that required for the high scale by this appendix, the State, local, or Federal span value may be approved, where a satisfactory explanation is included in the monitoring plan. Calculate the span for the additional (lower) range by multiplying the maximum expected concentration by 125 percent and by rounding up the resultant concentration to the nearest multiple of 10 ppm. The span value of this additional (lower) range will also be used to determine the concentrations of the calibration gases. Include the full-scale range setting and calculations of the MEC and span in the monitoring plan for the unit. Select the full-scale range of the instrument to be consistent with section 2.1 of this appendix, and to be greater or equal to the lower range span value. This selected monitor range with a span rounded up from 125 percent of the maximum expected concentration is the

“low-scale” of NO_x pollutant concentration monitors. NO_x pollutant concentration monitors on affected units with NO_x emission controls, or on other units with monitors using a low-scale range, must also be capable of accurately measuring up to 125 percent of the maximum potential concentration. For dual-span NO_x pollutant concentration monitors, determine the concentration of calibration gases based on both span values.

2.1.2.3 Auto-ranging monitors

For monitors that can continuously and automatically adjust their range of measurement, the monitor must be capable at any time of accurately measuring up to 125 percent of the maximum potential concentration as defined in section 2.1.2.1 of this appendix. Define the span value(s) for an auto-ranging monitor as 125 percent of the maximum potential concentration and 125 percent of the maximum expected concentration if a second span is determined to be necessary under section 2.1.2.2 of this appendix. Determine concentrations of the calibration gases based upon the span value(s).

2.1.2.4 Adjustment of Span

Wherever the actual NO_x concentration exceeds the maximum potential concentration but does not exceed the full-scale range for more than one clock-hour and the monitor can measure and record the NO_x concentration values accurately, the NO_x concentration values may be reported for use in the Acid Rain Program. If the concentration exceeds the monitor's ability to measure and record values accurately during a clock hour, and the full-scale exceedance is not during an out-of-control period, report the full-scale value as the NO_x concentration for that clock hour. If full-scale exceedances occur during more than one clock hour since the last adjustment of the full-scale range

setting, adjust the full-scale range setting to prevent future exceedances.

Whenever the fuel supply, emission controls, or other process parameters change such that the maximum expected concentration or the maximum potential concentration may change significantly, adjust the NO_x pollutant concentration span and monitor range to assure the continued accuracy of the monitoring system. Determine the adjusted span value using the procedures in sections 2.1.2.1 or 2.1.2.2 of this appendix. Select the new full scale range of the instrument to be greater than or equal to the adjusted span value and to be consistent with the guidelines of section 2.1 of this appendix. Record and report the new full-scale range setting, calculations of the span value, MPC, and MEC (if appropriate), maximum potential NO_x emission rate and the adjusted span value in an updated monitoring plan for the unit. In addition, record and report the adjusted span as part of the records for the daily calibration error test and linearity check required by appendix B of this part. Whenever the span value is adjusted, use calibration gas concentrations based on the most recent adjusted span value. Perform a linearity check according to section 6.2 of this appendix whenever making a change to the monitor span or range. Recertification under § 75.20(b) is required whenever a significant change is made in the monitor's range that requires an internal modification to the monitor (e.g., a change of measurement cell length).

2.1.3 CO₂ and O₂ Monitors

Define the "high scale" span value as 20 percent O₂ or 20 percent CO₂. All O₂ and CO₂ analyzers must have "high-scale" measure-

ment capability. Select the full-scale range of the instrument to be consistent with section 2.1 of this appendix, and to be greater than or equal to the span value. If the O₂ or CO₂ concentrations are expected to be consistently low, a "low scale" measurement range may be used for increased accuracy, provided that it is consistent with section 2.1 of this appendix. Include a span value for the low-scale range in the monitoring plan. Select the calibration gas concentrations as percentages of the span value.

2.1.4 Flow Monitors

Select the full-scale range of the flow monitor so that it is consistent with section 2.1 of this appendix, and can accurately measure all potential volumetric flow rates at the flow monitor installation site. For this purpose, determine the span value of the flow monitor using the following procedure. Calculate the maximum potential velocity (MPV) using Equation A-3a or A-3b or determine the MPV or maximum potential flow rate (MPF) in scfh (wet basis) from velocity traverse testing. If using test values, use the highest velocity measured at or near the maximum unit operating load. Calculate the MPV in units of wet standard fpm. Then, if necessary, convert the MPV to equivalent units of flow rate (e.g., scfh or kscfh) or differential pressure (inches of water), consistent with the measurement units used for the daily calibration error test to calculate the span value. Multiply the MPV (in equivalent units) by 125 percent, and round up the result to no less than 2 significant figures. Report the full-scale range setting, and calculations of the span value, MPV and MPF in the monitoring plan for the unit.

$$\text{MPV} = \left(\frac{F_d H_f}{A} \right) \left(\frac{20.9}{20.9 - \%O_{2d}} \right) \left[\frac{100}{100 - \%H_2O} \right] \quad (\text{Eq. A-3a})$$

or

$$\text{MPV} = \left(\frac{F_c H_f}{A} \right) \left(\frac{100}{\%CO_{2d}} \right) \left[\frac{100}{100 - \%H_2O} \right] \quad (\text{Eq. A-3b})$$

Where:

MPV=maximum potential velocity (fpm, standard wet basis),

F_d=dry-basis F factor (dscf/mmBtu) from Table 1, Appendix F of this part,

F_c=carbon-based F factor (scfCO₂/mmBtu) from Table 1, Appendix F of this part,

H_f=maximum heat input (mmBtu/minute) for all units, combined, exhausting to the stack or duct where the flow monitor is located,

A=inside cross sectional area (ft²) of the flue at the flow monitor location,

%O₂d=maximum oxygen concentration, percent dry basis, under normal operating conditions,

%CO₂d=minimum carbon dioxide concentration, percent dry basis, under normal operating conditions,

%H₂O = maximum percent flue gas moisture content under normal operating conditions.

If the volumetric flow rate exceeds the maximum potential flow calculated from the maximum potential velocity but does not exceed the full scale range during more than one clock hour and the flow monitor can accurately measure and record values, the flow rate may be reported for use in the Acid Rain Program. If the volumetric flow rate exceeds the monitor's ability to measure and record values accurately during a clock hour, and the full-scale exceedance is not during an out-of-control period, report the full-scale value as the flow rate for that clock hour. If full-scale exceedance occurs during more than one hour since the last adjustment of the full-scale range setting, adjust the full-scale range setting to prevent future exceedances. If the fuel supply, process parameters or other conditions change such that the maximum potential velocity may change significantly, adjust the range to assure the continued accuracy of the flow monitor. Calculate an adjusted span using the procedures in this section. Select the full-scale range of the instrument to be greater than or equal to the adjusted span value. Record and report the new full-scale range setting, calculations of the span value, MPV, and MPF, and the adjusted span value in an updated monitoring plan for the unit. Record and report the adjusted span and reference values as parts of the records for the calibration error test required by appendix B of this part. Whenever the span value is adjusted, use reference values for the calibration error test based on the most recent adjusted span value.

Perform a calibration error test according to section 2.1.2 of this appendix whenever making a change to the flow monitor span or range. Recertification under §75.20(b) is required whenever making a significant change in the flow monitor's range that requires an internal modification to the monitor.

2.2 Design for Quality Control Testing

2.2.1 Pollutant Concentration and CO₂ or O₂ Monitors

Design and equip each pollutant concentration and CO₂ or O₂ monitor with a calibration gas injection port that allows a check of the entire measurement system when calibration gases are introduced. For extractive and dilution type monitors, all monitoring components exposed to the sample gas, (e.g.,

sample lines, filters, scrubbers, conditioners, and as much of the probe as practicable) are included in the measurement system. For in situ type monitors, the calibration must check against the injected gas for the performance of all active electronic and optical components (e.g. transmitter, receiver, analyzer).

Design and equip each pollutant concentration or CO₂ or O₂ monitor to allow daily determinations of calibration error (positive or negative) at the zero- and high-level concentrations specified in Section 5.2 of this Appendix.

2.2.2 Flow Monitors

Design all flow monitors to meet the applicable performance specifications.

2.2.2.1 Calibration Error Test

Design and equip each flow monitor to allow for a daily calibration error test consisting of at least two reference values: (1) Zero to 20 percent of span or an equivalent reference value (e.g., pressure pulse or electronic signal) and (2) 50 to 70 percent of span. Flow monitor response, both before and after any adjustment, must be capable of being recorded by the data acquisition and handling system. Design each flow monitor to allow a daily calibration error test of (1) the entire flow monitoring system, from and including the probe tip (or equivalent) through and including the data acquisition and handling system, or (2) the flow monitoring system from and including the transducer through and including the data acquisition and handling system.

2.2.2.2 Interference Check

Design and equip each flow monitor with a means to ensure that the moisture expected to occur at the monitoring location does not interfere with the proper functioning of the flow monitoring system. Design and equip each flow monitor with a means to detect, on at least a daily basis, pluggage of each sample line and sensing port, and malfunction of each resistance temperature detector (RTD), transceiver or equivalent.

Design and equip each differential pressure flow monitor to provide (1) an automatic, periodic back purging (simultaneously on both sides of the probe) or equivalent method of sufficient force and frequency to keep the probe and lines sufficiently free of obstructions on at least a daily basis to prevent velocity sensing interference, and (2) a means for detecting leaks in the system on at least a quarterly basis (manual check is acceptable).

Design and equip each thermal flow monitor with a means to ensure on at least a daily basis that the probe remains sufficiently clean to prevent velocity sensing interference.

Design and equip each ultrasonic flow monitor with a means to ensure on at least a daily basis that the transceivers remain sufficiently clean (e.g., backpurging system) to prevent velocity sensing interference.

3. PERFORMANCE SPECIFICATIONS

3.1 Calibration Error

The initial calibration error performance specification of SO₂ and NO_x pollutant concentration monitors shall not deviate from the reference value of the calibration gas by more than 2.5 percent based upon the span of the instrument, as calculated using Eq. A-5 of this appendix. Alternatively, where the span value is less than 200 ppm, calibration error test results are also acceptable if the absolute value of the difference between the monitor response value and the reference value, $|R-A|$ in Equation A-5 of this appendix, is less than or equal to 5 ppm. The calibration error of CO₂ or O₂ monitors shall not deviate from the reference value of the zero- or high-level calibration gas by more than 0.5 percent O₂ or CO₂ as calculated using the term $|R-A|$ in the numerator of Eq. A-5 of this appendix. The calibration error of flow monitors shall not exceed 3.0 percent based upon the span of the instrument as calculated using Eq. A-6 of this appendix.

3.2 Linearity Check

For SO₂ and NO_x pollutant concentration monitors, the error in linearity for each calibration gas concentration (low-, mid-, and high-levels) shall not exceed or deviate from the reference value by more than 5.0 percent (as calculated using Equation A-4 of this appendix). Linearity check results are also acceptable if the absolute value of the difference between the average of the monitor response values and the average of the reference values, $|R-A|$ in Equation A-4 of this appendix, is less than or equal to 5 ppm. For CO₂ or O₂ monitors:

- (1) The error in linearity for each calibration gas concentration (low-, mid-, and high-levels) shall not exceed or deviate from the reference value by more than 5.0 percent as calculated using Equation A-4 of this appendix; or
- (2) The absolute value of the difference between the average of the monitor response values and the average of the reference values, $|R-A|$ in Equation A-4 of this appendix, shall be less than or equal to 0.5 percent CO₂ or O₂, whichever is less restrictive.

3.3 Relative Accuracy

3.3.1 Relative Accuracy for SO₂

The relative accuracy for SO₂ pollutant concentration monitors and for SO₂-diluent continuous emission monitoring systems used by units with a qualifying Phase I technology for the period during which the units

are required to monitor SO₂ emission removal efficiency, from January 1, 1997 through December 31, 1999, shall not exceed 10.0 percent except as provided below in this section.

For affected units where the average of the monitor measurements of SO₂ concentration during the relative accuracy test audit is less than or equal to 250.0 ppm (or for SO₂-diluent monitors, less than or equal to 0.5 lb/mmBTU), the mean value of the monitor measurements shall not exceed ± 15.0 ppm of the reference method mean value (or, for SO₂-diluent monitors, not to exceed ± 0.03 lb/mmBTU for the period during which the units are required to monitor SO₂ emission removal efficiency, from January 1, 1997 through December 31, 1999) wherever the relative accuracy specification of 10.0 percent is not achieved.

3.3.2 Relative Accuracy for NO_x

The relative accuracy for NO_x continuous emission monitoring systems shall not exceed 10.0 percent.

For affected units where the average of the monitoring system measurements of NO_x emission rate during the relative accuracy test audit is less than or equal to 0.20 lb/mmBtu, the mean value of the NO_x continuous emission monitoring system measurements shall not exceed ± 0.02 lb/mmBtu of the reference method mean value wherever the relative accuracy specification of 10.0 percent is not achieved.

3.3.3 Relative Accuracy for CO₂ and O₂ Pollutant Concentration Monitors

The relative accuracy for CO₂ and O₂ monitors shall not exceed 10.0 percent. The relative accuracy test results are also acceptable if the mean difference of the CO₂ or O₂ monitor measurements and the corresponding reference method measurement, calculated using Equation A-7 of this appendix, is within 1.0 percent CO₂ or O₂.

3.3.4 Relative Accuracy for Flow

Except as provided below in this section, the relative accuracy for flow monitors, where volumetric gas flow is measured in scfh, shall not exceed 15.0 percent through December 31, 1999. Beginning on January 1, 2000 (except as provided below in this section), the relative accuracy of flow monitors shall not exceed 10.0 percent.

For affected units where the average of the flow monitor measurements of gas velocity during one or more operating levels of the relative accuracy test audit is less than or equal to 10.0 fps, the mean value of the flow monitor velocity measurements shall not exceed ± 2.0 fps of the reference method mean value in fps wherever the relative accuracy specification above is not achieved.